Visualizing the Aesthetic Movement of *Selangkah Guru* by Motion Capture Technology

Wahyuni Masyidah M. I.¹, Nur Zaidi A.², Mohammad Kamal S.³ {missayuni11@gmail.com¹, zaidi82omatic@gmail.com², kamalsabran@gmail.com³}

School of the Art, Universiti Sains Malaysia^{1,2,3}

Abstract. Selangkah Guru is a Malay traditional exercise, and it is one of an essential cultural practice. The aesthetic movement from Selangkah Guru contains explicit and implicit visual meaning. Hence, by exploring Motion Capture Technology, the researcher are able to visualize the invisible visual aesthetic performed by Selangkah Guru. The study aims to visualize the invisible line captured from Selangkah Guru to understand the representation of the gesture. The researcher placed 29 markers reflector on Selangkah Guru performer's body joints. These markers visualize various trajectory lines from body movements. The finding suggests the significant correlation between visual aesthetic lines and their interconnection with Malay's philosophy and belief.

Keywords: Media Arts, Visual Culture, Malay Tradition, Technology.

1 Introduction

In 1999, according to Card, Mackinly & Sheiderman [1] explain that Information Visualization uses of computer-supported, interactive, visual representation of abstract data to amplify cognition. One visualization level is Visual Objects which refers to objects, especially virtual physical objects such as the human body to enhance with visualization techniques to package the collection of abstract information. Nowadays, visualization data has emerged as a powerful tool applicable widely in analysing and interpreting complex data in graphical or pictorial forms that ease the information's comprehension of the information [2]. Basically, visualization is a computing method that embraces image understanding and synthesis, which offers a method for seeing the unseen [3]. This computing method process unifies with various fields such as computer graphics, image processing, computer-aided design and more [3].

Consistent with current era of Industrial Revolution 4.0, culture studies are relevant to ensuring maintained one's heritage by documenting it, as communication and how people do things change dramatically [4]. Therefore, there are few previous studies, by applied technology of Motion Capture not only to preserve the knowledge of cultural heritage but also decode what is implied in cultural heritage art [5,6].

Generally, Motion Capture technology (MoCap) is a sensor technology that includes visual cameras and inertial measurement units (IMUs) have been widely recognized in various fields of human safety, health, games industry, film industry, medical and manufacturing [7,8,9], Sport [10], Dance [11,12] and Martial Art [13,14,15]. For the last few decades, Motion Capture Technology (MoCap) is an integral research tool used by bio mechanists to quantify human and

animal movement, and estimate kinetic parameters such as joints, moments, strength and force in certain specific area of space and time [16]. It is a digital process of tracking and recording objects or living beings [9]. Biomechanics has achieved successes in ergonomic, injury prevention, skill acquisition, locomotion, motor learning, physical therapy and rehabilitation [17,18]. In 2010, Gongbing Shan & Peter Visentin [19] suggested the potential of Motion Capture Technology (MoCap) in art known as Art Biomechanic which can involve a deeper discourse in exploring the relationship between art sketches and aesthetic results such as art or painting. Body gestures or movements in art contain information that communicates with the symbolism, tradition, art process, or existential nature of humanity that exists, thus carrying the meaning of depicting it through 3D motion [19].

Thus, this suggestion has opened up a new method to preserve and decode the knowledge of cultural heritage. Subsequently, in 2016, Nur Zaidi [5] have developed the method in his research by divided the visual into two groups namely (a) Macro Visual and (b) Micro Visual based on the Malay philosophy of Cosmology. His study aims to visualise the representation symbol implied *Silat* which involves a deeper discourse in Malay Philosophy of Belief and Martial art. Later, in 2020, Noorfarizah [6] adapted the method to visualise the *Tarian Menghadap Rebab*'s symbol and reveal a discourse on the perspective of nature and Islamic through literature.

This context aligned with Hooper-Greenhill [20] affirms that visual culture studies are an interdisciplinary field of study that appears with the interaction of anthropology, art history, philosophy, media studies and other disciplines that focus on a visual object or how images are created and used within society, to develop the understanding of the way of images and artefact can be analysed about the culture social and historical context.

Therefore, this paper is a study on the application of Motion Capture Technology to visualize the essence of aesthetics in *Selangkah Guru* movement. *Selangkah Guru* is an exercise movement originality from *Senaman Melayu Tua* [21]. This paper aims to visualize the unseen aesthetic embedded in *Selangkah Guru* excercise movement and identify the similarity in tangible aesthetic visual of Malay's art of wood carving as well as document the knowledge implied in the movement of *Selangkah Guru*.

2 Related to Work

According to history [22], Senaman Melayu Tua is a Malay traditional exercise that is exclusively practised by Malay Royal warriors for Silat martial art. Nowadays, it becomes inclusive and can be practised globally and locally by both Pesilat and non-Pesilat since 1999. Senaman Melayu Tua is unique in history, civilization and culture, along with Malay Philosophy and Islam Tassawuf [23]. It is a traditional therapeutic exercise for rehabilitee and maintaining physical as well as spiritual well-being. On 18 Feb 2011, the Ministry of Health Malaysia recognised it as an Alternative Treatment Method that is suitable for the public, which can enhance the benefit of physical health and functions as a self-defences movement [24].

Selangkah Guru is a fundamental set of traditional exercise movements for the beginner of Senaman Melayu Tua practitioners [25]. This exercise is moderate-intensity exercise purposely

to improve the flexibility, physical and balance inner spiritual as a whole. To nurture the belief, maintaining harmony physically and spiritually is a fundamental practice in *Selangkah Guru* [26].

Selangkah Guru consists of explicit and implicit meaning; of Malay movement and Philosophy of life that can be defined as: wholehearted accept what has been decreed by the Almighty, stay aware and be prepared for what may come, always stay genuine, positive, and never give up [27]. The aesthetic value of this exercise shows the virtuous civilization of Malay Culture and belief.

Hence, this paper is to disclose deeper discourse of Malay's aesthetic movement through the application of Motion Capture Technology. In this paper, the researcher partially unfolds the aesthetic visual finding of *Selangkah Guru* movement due to the trajectory line of Motion Capture Technology appearing on frame of 0 to 1000 frames that consisting of 1 to 11 steps of *Selangkah Guru* Movement.

Previous studies of the application of Motion Capture Technology in Malay Heritage [5,6], showing the hidden symbolism in the Malay movement of Martial art and dance that have interconnection of Malay Culture and Belief. The concept of symbol is divided into 2 [5] namely (a) Macro Cosmo and (b) Micro Cosmo, which adapted from Islam view on the symbol [28,29]. By acknowledging this concept from previous study, in visual studies, body gesture is recognized as Macro Visual. It is literally perceived by eyes and the visual appears via Motion Capture Technology is Micro Visual .

Generally, Motion Capture is usually acknowledged as a tool to measure motion analysis but, in this paper, objectively untangle the form created by light (Point of Reflector) that moved by Kinetic Energy (Body Gesture of Selangkah Guru) in space. The proto-element [30] of design is a point or dot, each dot to another with a close-range construct line. The application of line can be the appearance, texture, pattern as well as depiction of shape, space and movement in visual art. Therefore, this paper aims to reveal the trajectory line created from the Selangkah Guru movement and to discourse the connection of aesthetic practice embedded in Malay Culture.

3 Method

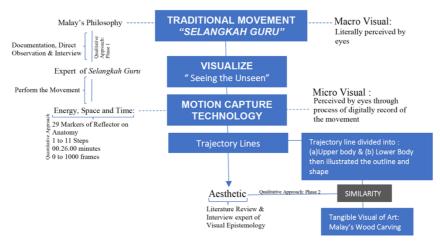


Fig 1. Diagram flow of method research in visualizing *Selangkah Guru* by Motion Capture Technology (Resource : Researcher)

Based on **Figure.1** explain this research consist of both approaches of quantitative and qualitative. The qualitative approach has been applied into two phases namely:

- (a) Phase 1 is before the digital process: included interview expert of *Selangkah Guru* and direct engangement with the *Senaman Melayu Tua* community, and to acquire and document the understanding of *Selangkah Guru* movement and the philosophy.
- (b) Phase 2 is after acquired digital data: interview expert of Visual Espitemology and, refer to the literature review related to aesthetic and Malay's Wood Carving to identify the similarity.

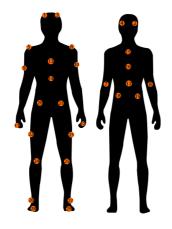
As mention before, Macro Visual is the body gesture, in order to understand the significance of the movement, the approach of interview and direct participation are needed in this study. Refer to **Figure. 1**, through interview and direct participation, the researcher can understand the intrinsic value of this cultural preservation in *Senaman Melayu Tua* community. Simultaneously, unfold the philosophy of Malay that is embedded in the *Selangkah Guru* exercise movement. Explicitly, in this moderate-intensity exercise, each joint of body; from head to toe, is important as it relates to movement flexibility [31]. Implicitly, the collaboration of mind and physical is important in achieving the balance of life, therefore, *Selangkah Guru* is a fundamental practice to nurture and unite self belief, spiritual harmony and physical [32]. The philosophy of *Selangkah Guru* generally taught self-aware and preparation of life journey in achieving the objective of life [33].

In order to obtain the visualization line of Micro Visual, the application of Motion Capture is needed in this study. Referring to **Figure. 1**, the quantitative approach merely applied in digitally recording the *Selangkah Guru* movement performed by the expert. This process required certain specific tools such as Motion Capture suit, marker reflector, and space equipped with IMUs camera (Refer to **Figure. 2**). In this process, the performer needs to wear a complete Motion Capture suit then a total of 29 marker reflector placed on the suit (Refer to **Figure. 3**). As shown in **Figure. 4**, the function of the marker reflectors is to create the trajectory line by the

movement of the performer, simultaneously, the movement captured by the IMUs camera. Shortly afterwards, the trajectory line will appear through Cortex software in the frame of time.



Fig. 2.: (a) Motion Capture space that equipped with 8 units infra-red camera of inertial measurement units (IMUs), (b) Marker Reflector indicator, (c) Motion Capture suit made of polyproline, (d) Head Cap & (d) a pair hand gloves (Resource: Researcher)



No.	Point of	No.	Point of	N	Point of
	Reflector		Reflector	0.	Reflector
	(Upper Body)		(Upper Body)		(Lower Body)
1	Right Front Head	13	Chest	18	Right Hip
2	Right Rear Head	14	Sternum	19	Left Hip
3	Left Front Head	15	Upper_Back	20	Right Pelvic
4	Left Rear Head	16	Medium_back	21	Left Pelvic
5	Right Shoulder	17	Lower_Back	22	Right Thigh
6	Left Shoulder			23	Left Thigh
7	Right Elbow			24	Right Knee
8	Left Elbow			25	Left Knee
9	Right Arm			26	Right Ankle
10	Left Arm			27	Left Anke
11	Right Finger			28	Right Toe
12	Left Finger			29	Left Toe

(a) Front View (b) Rear View

Fig. 3. The numbers is referring the points of marker reflector that placed on performer's body then the trajectory lines divide into two part namely **(a) Upper body** and **(b) Lower body** (Resource: Researcher).

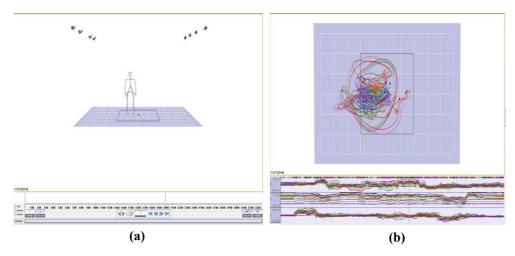


Figure. 4: Digital visual through Cortex Software (a) Front view of the performer, (b) Top view of performer: Trajectory line appear while performance of *Selangkah Guru* (Resource: Researcher).

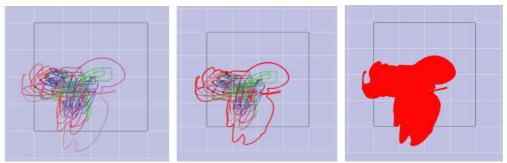


Figure. 5: Example illustration process from the data of trajectory line from top view (Resource: Researcher).

Then the data trajectory line data were divided into two part (a) Trajectory line of Upper Body, and (b) Trajectory Line of the Lower Body (Refer **Figure. 3**). This digital visual will be illustrated into an outline and form from Top, Side and Front (Refer **Figure. 5**). After the data obtained, an interview with an expert of Visual Epistemology was conducted to validate the correlation aesthetic between the digital data and the Malay's wood carving.

In this paper, research focuses only on the 1 to 11 steps of *Selangkah Guru* movement, consisting of 0 to 1000 frames that are equivalent to 00.26.00 minutes. Each step of Selangkah Guru implied philosophy (**Table. 1**). A total of 6 visual trajectory lines were obtained extract from the digital data of Motion capture from the view of Top, Side and Front.

4 Finding: Qualitative Data of 11 steps of movement involved in 0-1000 frame of Motion Capture Data (Macro Visual)

No.	1	2	3	4
BODY POSTURE				

METHOD OF MOVEMENT	Stand Firm	As you step forward with hand right in attack position. And your left hand moves in position "menyelak", which can function either defense or attack.	Glance before turning your head to left.	Turn the whole body to the right in the move of Langkah laksamana and 'Jual' rusuk kanan. Right hand in ready position to hit an inch to break the ribs known as pukulan yatim piatu i.e pukulan 7 hari
PHILISOPHY OF <i>SELANGKAH GURU</i>	Calm yourself & be ready: The definition of calm in this context, is silence everything in your mind and focus then "letak diri dalam diri" means surrender yourself to Allah as we are only human and powerless, and all the movements is from the force of Allah. Be ready in this context means always ready to move in 4 elements of fire, air, water and soil.	Hands up known as 'makan gerak' symbolize in life, you need to observe thoroughly your plan and must accomplish it.	Looking at the left symbolize you need to identify the obstacle of your plan and be ready for it.	Right-hand position signifies Be ready to face all the obstacles that's coming and ready to overcome it.

No.	5		6	7		8
BODY POSTURE	X					X
METHOD OF MOVEMENT	Move your leg left an inch to the front in <i>Pecah Tapak 3</i> . Your left hand in ready position to receive attack known as <i>Selak Dahan Keluar</i> ; lengan luar kanan musuh yang menikam	Move your right leg across behind the left leg means you are in <i>Tenteng'</i> position. Your hand in ready to attack known as tangan kanan menikam rusuk		Slightly glan your right	ace to	Move your left leg in Pecah Tapak 3 with <i>gelek</i> pinggang and rise up slightly. While moving your right hand in the position of Kelek siku (Buah dalam), the other is in ready mode.
PHILISOPHY OF SELANGKAH GURU	Left-hand position denotes: Accept all the obstacles, figure it and overcome it.	The low position of standing represent Whatever challenge may pressure you; you need always to be ready.		This position signifies: In whatever circumstance pressure you, must rise.	s that	The fast change of this position means a Rise up in speed from any challenges to achieve your goal. Right hand means to beat all enemies and obstacles.
BODY POSTURE	9					

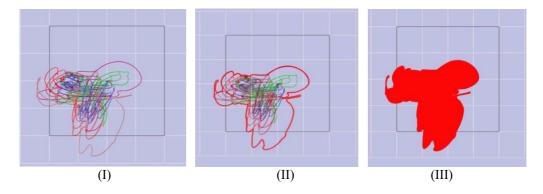
METHOD OF MOVEMENT	Rise up your body and attack with "buah hujung"	Turn you head to front and ready to <i>Ambil angin</i>	Move your leg and body to front stand firm then your hand in <i>Ambil Angin</i> position.
PHILISOPHY OF SELANGKAH GURU	The position means: Keep overcome and facing the challenge to achieve the goal.	The position signifies: Be ready to take some air and observe calmy.	Rise up and stay calmly, then re-plan again your goal to succeed. Calm yourself by surrender to Allah.

Table 1.: The description of body posture, method movement and philosophy of *Selangkah Guru* 1 to 11 step movements that involve in 0 -1000 frame of Motion Capture (Resource: Researcher).

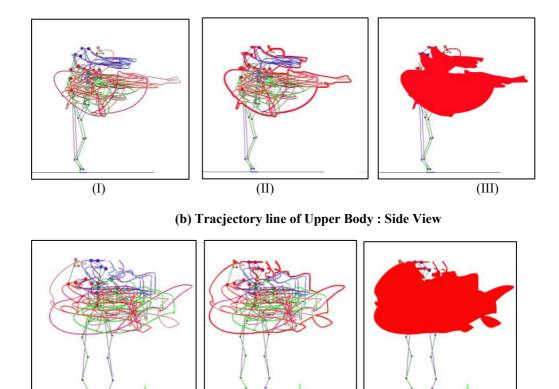
The data of **Table 1** are acquired through interview and direct participate in the *Senaman Melayu Tua* community since 2019 until today. Due to pandemic, the interview and the class session are still on going online..

4.1 Finding: Quantitative Data of Micro line visualization from Frames of 0 - 1000

From the Motion Capture Technology digital data analysis, 6 images that are visualized from the frames of 0-1000, then it has been illustrated to trace the outline and form. As mentioned before, each joint are important to move the body into movement. Hence researcher divides this data into 2 part namely (I) Upper Body and (II) Lower Body in order to identify the aesthetic of trajectory line appear in the movement of 0 to 1000 frames. Each Upper Body and Lower Body are divided into 3 view, there is (a) Top View (b) Side View and (c) Front View. In this study, the researcher focus on the aesthetic outline of the trajectory line to identify the form appeared from the movement.



(a) Tracjetory line of Upper body: Top View



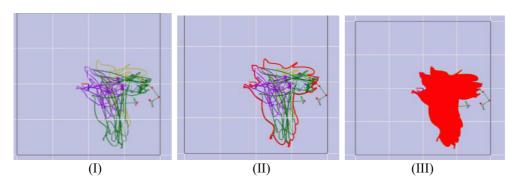
(c) Tracjetory line of Upper Body: Front View

(III)

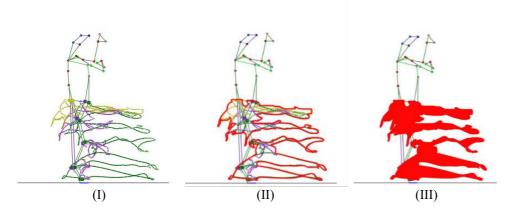
Figure. 6: Different view of Upper Body and the processes to identify the aesthetical of trajectory line: (I) Trajectory line from Cortex software (II) Trace the outline of the trajectory line (III) The form appear from the outline (Resource : Researcher)

(II)

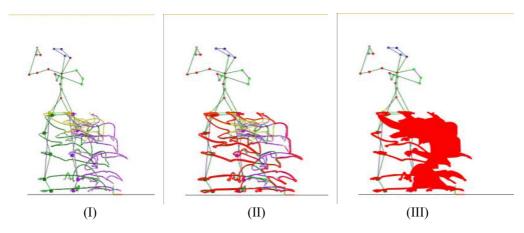
(I)



(a) Tracjetory line of Lower Body: Top View



(b) Tracjetory line of Lower Body: Side View



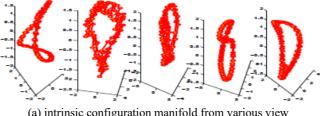
(c) Tracjetory line of Lower Body: Front View

Figure. 7: Different view of Lower Body and the processes to identify the aesthetical of trajectory line:

(I) Trajectory line from Cortex software (II) Trace the outline of the trajectory line

(III) The form appears from the outline (Resource: Researcher)

Based on the **Figure.6** and **Figure.7**, there is various spiral line character entanglement in each image of (I) Trajectory line of from Cortex Software. There is non-sharp edges in each image of (II) Trace the outline of the trajectory and in each image of (III), the form that appears from the outline is asymmetry. This finding inline the function of Motion Capture is to visualize the basically nonlinear energy, asymmetry, entanglement and multiple points of view [34]. The spiral visual of the line is related to the Torus line, the structure of magnetic field behaviour. This micro line of the torus has existed in human movement [35] (Refer to **Figure. 8**).



(a) intrinsic configuration manifold from various view

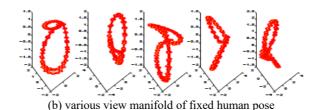


Figure. 8: Example of micro-Torus line in human body from different of view and fixed body pose (Resource: Ahmad Elgammal & Chan-Su Lee, 2008 [35])

The element pattern of the line shown in **Figure.** 6 and **Figure.** 7 is circular and interconnected. The significant correlation between the spiral or the micro Torus line and Malay culture can be seen in Malay's art. However, the noticeable difference is between symmetry and asymmetry. It is because symmetry doesn't happen naturally. For instance, externally, the human body is symmetrical appear but internally view, most organs are asymmetrical with respect to bilateral coordination, e.g the right lung is shorter and wider than the left lung and trilobed. In contrast, the left is bilobed [36]. The symmetrical proportion can be seen in Malay wood carving (Figure 9, 11, 12 & 13). Malay's aesthetic philosophy is an expression of appreciation of the Almighty Allah, His creation and perfection. The Muslim community is encouraged to appreciate aesthetic as it is in line with the Prophet's hadith, which stated that Allah is beautiful, He loves beauty [37] [38]. This harmonious element of aesthetic can be seen in Malay's wood carving as they understand the concept of value decency relation between (a) Allah (god/force), (b) Human and (c) Universe [39]. Therefore, Zaidi [5] stated that Malay's artwork consists of the nature understanding concept of bilateral coordination that implicitly leads to *Tauhid* or monotheism belief.

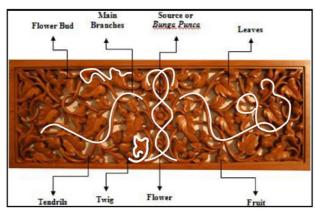


Figure. 9: Example *Awan Larat* of Malay wood carving that appear the energy of flow through flower motif (Resource: Nursuriani & Ismail, 2013 [40]; Illustration: Researcher)



Figure. 10: Decoration Wood Carving of "*Bangau*" on traditional boat of Kelantan and Terengganu (Resource: Abdul Halim Nasir, 2016 [41]; Illustration: Researcher)



Figure. 11: Window lattice wood carving of *Rumah Bumbung Panjang* in Perlis. (Resource: Abdul Halim Nasir, 2016 [41]; Illustration: Researcher)

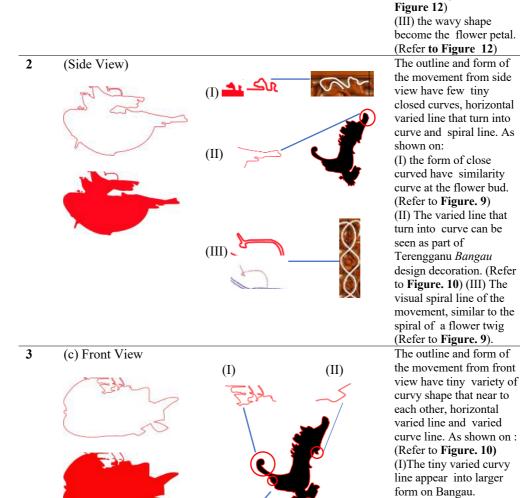


Figure. 12: Wall Carving of Malay traditional house in Gombak, Selangor. (Resource: Abdul Halim Nasir, 2016 [41]; Illustration: Researcher)



Figure. 13: Decoration motive of *Dinding Serambing* of Malacca traditional House (Resource: Abdul Halim Nasir, 2016 [41]; Illustration: Researcher)

No.	Outline and form of Upper Body Movement From:	Image analysis of similarity	Description of the visual
1	(a) Top View		The outline and form of the movement from top view show the big range of curves, oval, skewed curve that capture from the movement of Selangkah guru. As shown on: (I) The repeated rhythm of skewed curve shows at the flower bud of wood carving at Figure. 9. (II) This shape is similar to parabola curve that



can be seen as part of the flower motif while the tiny straight form for flower twig. (Refer to

(II) & (III) The varied line and curve form as part of Terengganu *Bangau* design.
(III) The rhythm of

intricacy and complecity curve become as part of aesthetic value on

bangau.

Table 2: Descriptive Analysis of Micro Outline and Form of Trajectory line from *Selangkah Guru* movement of Lower Body from Top View, Side View and Front View (Resource: Researcher)

(IV)

(III)

No.	Outline and form of lower body movement from:	Image analysis of similarity	Description of the visual
1	Top View	(III) (IV)	The outline and form of the movement from top view show variety of curve in both close and distant range, the overall shape of curve is impressive. As shown on: (Refer to Figure. 10) (I)The repetition of complexity rhythm is similar on Kelantan <i>Bangau</i> decoration. (II)The graceful curve appear on the top of <i>Bangau</i> design that add the value of rhythm. (III)The smooth curve turn into varied tiny curve appear at below of Kelantan <i>Bangau</i> decoration. (IV) The similar peak curve add the value of aesthetic form of the <i>Bangau</i> .
2	Side View		The outline and form of the movement from side view show variety horizontal varied line that bifurcated from the right side and skewed curve in varied direction. As shown on: (I)The similarity can be seen when the changes of direction into vertical view, the form have slightly similar to window lattice design of traditional house (Refer to Figure. 11). (II) The similarity can be seen when the changes of mirror direction, it shows the skewed curve similar to leave of <i>Dinding Serambi</i> (Refer to Figure. 13)
3	Front View		The outline and form of the movement from front view show a variety of horizontal varied line that bifurcated on the left side and skewed curve in varied upper direction. As shown on: (I)The smooth curvy can seen on the petal pattern, the bifurcated form appear on the twig of the flower pattern (Refer to Figure. 12). (II) the form of the branch similar to flower bud pattern of Dinding

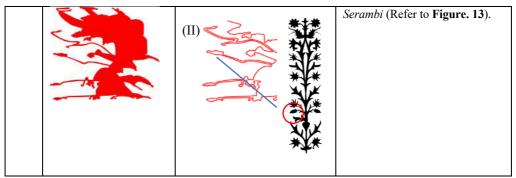


Table 3: Descriptive Analysis of Micro Outline and Form of Trajectory line from *Selangkah Guru* movement of Lower Body from Top View, Side View and Front View (Resource: Researcher)

Based on analysis descriptive of Table 2 and Table 3, the Micro visual obtained from Selangkah Guru Movement has unfolded various forms of lines and curves attended by interesting elements of rhythm, value, and repetition. After examining the data, shows that these shapes, forms, and lines are already implemented in Malay Decorative of art [40] for the century. This clearly signified that; Malay culture has its own ethnoscience knowledge that can unfold through cultural practice. The Torus line is an energy behavior or force that naked eyes cannot see, yet if we observe deeply on Malay's art, there are often seen the variety of spiral and curve lines. This vividly in line with Malay Philosophy of Life, namely in life we as a human must maintain the value decency relation between (a) Allah (God/ the force), (b) Human and (c) Nature/ Universe [39]. In Malay's art, this expression of decency can be seen visually through Malay Motif/ Pattern of Cosmology, Flora, Fauna, and Khat Calligraphy. The expression of Malay's art is an appreciation toward the creator (Allah/ force) of nature [37]. This is parallel with Selangkah Guru movement philosophy; wholehearted accept what have been decreed by the Almighty. This clearly stated that the aesthetic of the trajectory line of Selangkah Guru Movement is Malay ethnoscience knowledge embedded in Malay Movement practice and Culture for centuries and practiced in culture subtly.

5 Conclusion

Nowadays, the advancement of technology has made a significant change to help us preserve our local culture knowledge. In this context, the technology of Motion Capture not only help us preserve the cultural movement in accurate scientifical data, yet it is also able to unfold the denotation of the culture through digital preservation. Undeniable, applying this technology is complex as it consists of many different connected parts and, certain suit and spatial, yet it is worthy of exploring certain subtle areas of cultural studies. As for the context of *Selangkah Guru* movement, through Motion Capture, the trajectory line of energy movement shows various spirals line that similar to Malay's Art. In the meantime, this digital image scientifically denotes subtleties aesthetic essence in Malay Motifs pattern, it is not just simply the expression of appreciation of art. However, it is an ethnoscience knowledge that has been practiced in Malay Culture as a whole. Therefore, this research is crucial to provide a clear guideline for future interdisciplinary visual culture studies research.

Acknowledgments. The authors wish to thank all participants for their collaboration in this study.

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